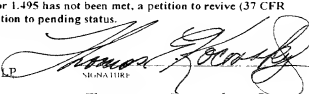


U.S. APPLICATION NUMBER: 097/831213 INTERNATIONAL APPLICATION NO.: PCT/F199/00928	ATTORNEY'S DOCKET NUMBER: MED 2 1233 US <div style="border: 1px solid black; padding: 5px;"> CALCULATIONS PTO USE ONLY </div>
17 <input checked="" type="checkbox"/> The following fees are submitted: BASIC NATIONAL FEE (37 CFR 1.492 (a) (1) - (5)): Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO and International Search Report not prepared by the EPO or JPO \$1000.00 International preliminary examination fee (37 CFR 1.482) not paid to USPTO but International Search Report prepared by the EPO or JPO \$860.00 International preliminary examination fee (37 CFR 1.482) not paid to USPTO but international search fee (37 CFR 1.445(a)(2)) paid to USPTO \$710.00 International preliminary examination fee paid to USPTO (37 CFR 1.482) but all claims did not satisfy provisions of PCT Article 33(1)-(4) \$690.00 International preliminary examination fee paid to USPTO (37 CFR 1.482) and all claims satisfied provisions of PCT Article 33(1)-(4) \$100.00	
ENTER APPROPRIATE BASIC FEE AMOUNT = \$ 1,000.00	
Surcharge of \$130.00 for furnishing the oath or declaration later than <input type="checkbox"/> 20 <input type="checkbox"/> 30 months from the earliest claimed priority date (37 CFR 1.492(e)) \$	
CLAIMS	NUMBER FILED
Total claims	10 - 20 =
Independent claims	4 - 3 =
MULTIPLE DEPENDENT CLAIM(S) (if applicable)	
TOTAL OF ABOVE CALCULATIONS = \$ 1,080.00	
<input type="checkbox"/> Applicant claims small entity status. See 37 CFR 1.27. The fees indicated above are reduced by 1/2. \$	
SUBTOTAL = \$ 1,080.00	
Processing fee of \$130.00 for furnishing the English translation later than <input type="checkbox"/> 20 <input type="checkbox"/> 30 months from the earliest claimed priority date (37 CFR 1.492(f)) \$	
TOTAL NATIONAL FEE = \$ 1,080.00	
Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31) \$40.00 per property \$ 40.00	
TOTAL FEES ENCLOSED = \$ 1,120.00	
Amount to be refunded: \$ charged: \$	
a. <input checked="" type="checkbox"/> A check in the amount of \$ <u>1,120.00</u> to cover the above fees is enclosed. b. <input type="checkbox"/> Please charge my Deposit Account No. _____ in the amount of \$ _____ to cover the above fees. A duplicate copy of this sheet is enclosed. c. <input checked="" type="checkbox"/> The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. <u>06-0308</u> . A duplicate copy of this sheet is enclosed.	
NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the application to pending status.	
SEND ALL CORRESPONDENCE TO: Thomas E. Kocovsky, Jr. FAY, SHARPE, FAGAN, MINNICH & MCKEE, LLP 1100 Superior Avenue, Seventh Floor Cleveland, OH 44114-2518 (216) 861-5582	
 _____ NAME Thomas E. Kocovsky, Jr. NAME 28,383 REGISTRATION NUMBER	

Form PDS-139 (REV. 10-2000) page 2 of 2

(Transmittal Letter to the United States Designated Office (DO/US)—Entry Into National Stage under 35 U.S.C. 371—PTO 1390 [13-7]—page 2 of 2)

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of:) Examiner: Unknown
M. SALMISUO)
Serial No.: Unknown) Art Unit: Unknown
Filed: Herewith)
For: METHOD AND DEVICE FOR)
TREATING WATER FOR)
EVAPORATION)
Attorney Docket No.:) Cleveland, OH 44114
MED 2 1233 US) May 3, 2001

PRELIMINARY AMENDMENT A

Assistant Commissioner
For Patents
Washington, D.C. 20231

Dear Sir:

In the Abstract:

Please cancel the abstract and add the following abstract:

-- Abstract of the Disclosure

In the production of water vapor, particularly in the production of especially clean water vapor, dissolved gases, mainly atmospheric gases, are removed from feed water (2). The feed water is sprayed by a spray nozzle (3) mounted in a hemispherical chamber (1) in a spray pattern which matches an area of an upper end (4) of an arrangement of vertical feed tubes of a falling film evaporator. The dissolved gases are liberated quickly from the sprayed droplets and removed through outlets (5) in the hemispherical chamber. The sprayed droplets collect at the upper ends of the vertical evaporation channels and are distributed evenly thereamong before atmospheric gases can be redissolved. --

"Express Mail" Mailing Label Number EL852677655US

Date of Deposit: MAY 3, 2001

I hereby certify that this paper or fee is being deposited with the United States Postal Service "Express Mail Post Office to Addressee" service under 37 C.F.R. 1.10 on the date indicated above and is addressed to:
Assistant Commissioner for Patents Washington, D.C. 20231.

Hilary M. McNulty
By: Hilary M. McNULTY

In the Claims:

Please amend claim 4 as follows:

4. (Amended) [An] The apparatus as defined in claim 2 [or 3], **characterised** in that it comprises a substantially hemispherical chamber, the end of the evaporator tube arrangement forming the plane side
5 thereof.

A clean copy of claim 4 amended is as follows:

4. (Amended) The apparatus as defined in claim 2, **characterised** in that it comprises a substantially hemispherical chamber, the end of the evaporator tube arrangement forming the plane side
5 thereof.

Please add new claims 5-10 as follows:

5. The apparatus as defined in claim 3, **characterised** in that it comprises a substantially hemispherical chamber, the end of the evaporator tube arrangement forming the plane side thereof.

6. A method of feeding water to heat transfer surfaces of a falling film evaporator having vertical evaporation channels, the method comprising:
spraying drops of water with absorbed
5 atmospheric gases to distribute the water over upper ends of the vertical evaporation channels;

simultaneously with the spraying, separating the atmospheric gases from the water.

7. The method as defined in claim 6 further including:

collecting the sprayed droplets into a layer of water above the upper ends of the vertical evaporation channels;

separating additional atmospheric gases from the water layer;

feeding water from the water layer into the upper ends of the vertical evaporation channels.

8. An apparatus for removing dissolved atmospheric gases from water, the apparatus comprising:

a falling film evaporator which includes a plurality of vertical evaporating channels, the vertical evaporating channels having upper ends arranged in an evaporator channel upper end arrangement;

at least one spraying device which breaks the water into a spray of droplets having a spray pattern which corresponds to an area of the vertical evaporating channel upper end arrangement; and

at least one dissolved gas outlet for removal of the gases separated from the droplets.

9. The apparatus as set forth in claim 8 wherein the vertical evaporating channel upper end arrangement is confined to a circular area and further including a hemispherical chamber mounted to the vertical evaporating channel upper end arrangement, the spraying device being mounted to the hemispherical chamber such that the spray of droplets is confined within the hemispherical chamber.

10. The apparatus as defined in claim 8 further including:

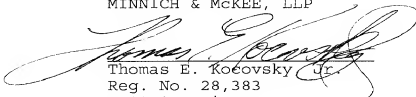
a perforated plate mounted above and separated from the evaporator channel upper end arrangement, the spray of droplets being sprayed onto the plate, the water passing through perforations in the plate to the evaporator channel upper ends.

REMARKS

This amendment is to remove multiple dependencies and place the claims in better form for U.S. examination and allowance. An early allowance of all claims is earnestly solicited.

Respectfully submitted,

FAY, SHARPE, FAGAN,
MINNICH & McKEE, LLP



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U9 / 831213
JCI Rec'd PC1/PTO 03 MAY 2001

METHOD AND DEVICE FOR TREATING WATER FOR EVAPORATION

The invention relates to the production of clean vapour. In particular, the invention relates to the removal of dissolved gases from the feed-water when using a falling film evaporator.

When producing especially clean water vapour, particularly for sterilisation purposes, the feed-water to be evaporated has to be purified of the gases dissolved therein, among other things, to maximise the concentration of the vapour that is generated and, consequently, the condensation heat, and to minimise the corrosive effect. The gases dissolved in the feed-water are mainly atmospheric gases: nitrogen, oxygen, carbon dioxide and argon. The solubility of the gases in the water is at the lowest near the boiling point of the liquid.

According to a commonly used standard, for example, the vapour may not contain more than 3,5 % non-condensable gases. To remove the dissolved gases, pre-degassing chambers where the heated water has stayed in the gas space for such a long time that the gases have had time to bubble out, as is described in Finnish patent 77 80, have been used in the water feed line.

A falling film evaporator comprises usually a vertical tube bundle, the heating medium, like vapour, a heat transfer fluid or a flue gas being located on the outside. The liquid to be evaporated is fed from above and it flows as a film along the inner walls of the tubes, partly evaporating. The vapour that was generated flows downwards together with the liquid film and is separated from the non-evaporated liquid in the lower part of the evaporator.

Usually, the main problem with the falling film evaporator is the spreading of the liquid into an even film into the tubes. Often a perforated plate arrangement disposed above the smoothed tube end plane is employed. Other solutions are individual distributors or nozzles at the tube ends.

For the degassing of liquids, solutions are known wherein the hot liquid is broken into a fine spray to make the gas bubbles that are generated separate effectively from the liquid phase as a result of a large liquid-gas interface and a short way of travel. The method is used for the degassing of steam boiler water, as disclosed in U.S. Patent 5,201,366, for example, and for the stripping of volatile substances from a liquid phase, as disclosed in publication EP-A 167 647. Besides, negative pressure is often used in the space into which the liquid phase is sprayed.

An apparatus for the removal of gases from water to be used as surgical rinse water is known from U.S. Patent 4,816,044. The apparatus comprises a degassing chamber and the feed-water is sprayed into the upper part thereof. The gases are removed through a pump arrangement generating a slightly negative pressure in the gas space of the degassing chamber.

Methods and apparatuses for distributing feed-water evenly to the inlet of the evaporator channel assembly of an evaporator by using spray nozzles are known from U.S. Patents 3,332,469 and 4,683,025.

Disclosure of the invention

The method according to claim 1 has now been invented for distributing feed-water effectively to the beginning of the heat-transfer surfaces of a falling film evaporator by removing the gases dissolved in the water and preventing them from re-dissolving at the same time. Another object of the invention is the device according to claim 2 which makes it possible, in a falling film evaporator, in the same operation, to remove the gases from the feed-water and to distribute it evenly into the tube bundle of the evaporator. The apparatus comprises an evaporator top and at least one spraying device arranged therein. In this case, the spraying device is a nozzle, a mist sprayer or a similar device for creating a spray of liquid of a given shape.

The hit pattern of the spraying device or devices is dimensioned in such a way that when water is fed through the device, the water is evenly distributed as droplets over the entire tube end plane under the top. Besides, the spray of droplets results in a large gas-liquid

interface. Owing to the fact that the liquid discharged from the spraying device is heated, the gases dissolved in the liquid separate very quickly from the liquid phase at the same time as part of the liquid evaporates. Because the liquid phase distributed as droplets reaches the evaporator channel assembly in a very short time, no gases re-dissolve in the phase before the evaporation starts, as could happen in devices according to the state of the art, wherein the separation of gases was carried out, for example, in a separate chamber.

In addition to the spraying device, the evaporator top comprises an outlet or outlets for removal of the gases. Part of the vapour that was generated in the discharging phase acts as a carrier in the outflow.

The distribution of the liquid into the evaporator channel assembly can also be affected by arranging a perforated trough above the ends of the evaporator tubes, wherein the water remains as a thin layer before flowing into the evaporator tubes. Dissolved gases can also separate from the thin layer.

Brief description of the drawing

Figure 1 is a sectional side view of the apparatus according to the invention, and

Figure 2 is a sectional side view of another embodiment of the apparatus according to the invention.

Detailed description

The invention will be described in more detail below, with reference to the accompanying drawing. 1 is a dome-shaped top of a falling film evaporator. The evaporator resembles a tube and shell heat exchanger placed in a vertical position. The feed-water is delivered through line 2 where it can be in a pre-heated state of, for example, 120 °C. In line 2, the pressure is preferably about 0.3 to about 6 bar higher than the pressure of the clean vapour to be produced.

The nozzle 3 is selected to provide, in the pressure range used, a hit pattern that substantially corresponds to the shape and size of the tube end plane 4. Suitable nozzles meeting the pressure and temperature requirements are commercially available. In this

embodiment, the nozzle is placed in a symmetrically perpendicular position above the tube end plane but it can also be disposed in other ways. Further, more than one spraying device can be employed in order to achieve an even hit pattern. When the heated water is discharged from the nozzle 3 as a spray of droplets, the gases dissolved in the water separate quickly from the droplets and leave through the outlets 5 together with a small quantity of carrier vapour. The degassed droplets of water are distributed evenly into the evaporator tube assembly, and, in contrast to conventional evaporators, a perforated plate or another kind of distributing plate is not necessarily needed above the tube end plane 4. The water reaches the tube ends in a very short time, as a result of which the transfer of heat from the tube wall to the water starts practically immediately.

The distance between the nozzle 3 and the tube end plane 4 is preferably about half the diameter of the plane 4. The apparatus can be provided with a sight glass 6.

Preferably, the separated gases and the carrier steam are led into a heat exchanger where the thermal energy thereof is utilised for pre-heating the feed-water.

In the embodiment shown in Figure 2, the apparatus is further provided with a trough 7 that has a perforated bottom and that is arranged above the tube end plane 4 by means of a spacer 8. In this embodiment, a thin layer of water, from which gases still can separate before the water moves to the ends of the evaporator tubes through the bottom holes of the trough, accumulates in the trough 7.

14-11-2000

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Claims

1. A method of feeding water to the heat transfer surfaces of a falling film evaporator having vertical evaporation channels, by distributing the water as a spray of drops to the
5 beginning of the heat transfer surfaces, **characterised** in that water soluble, essentially atmospheric gases are simultaneously separated from the water.
2. An apparatus for removing dissolved gases from water to be evaporated in connection with a falling film evaporator, which apparatus comprises vertical evaporating channels
10 and at least one spraying device (3) for breaking the heated feed-water into a spray of droplets having a hit pattern substantially corresponding to the area of the upper end (4) of the evaporator channel arrangement, **characterised** in that it comprises at least one outlet (5) for the removal of gases separating from the droplets.
- 15 3. An apparatus as defined in claim 2, **characterised** in that it comprises a trough having a perforated bottom and lying above the upper end (4) of the evaporator channel arrangement.
- 20 4. An apparatus as defined in claim 2 or 3, **characterised** in that it comprises a substantially hemispherical chamber, the end of the evaporator tube arrangement forming the plane side thereof.

(57) Abstract

In the production of water vapour, in particular in the production of especially clean vapour, it is essential that the gases dissolved in the feed-water, which are mainly atmospheric gases, are removed. When using a falling film evaporator, it is important to distribute the feed-water evenly on the heat transfer surfaces. In the method and apparatus according to the invention, the degassing and the even distribution of water take place at the same time when spraying the feed-water to the beginning of the heat transfer channel assembly evenly as fine droplets from which the gases can separate quickly. There is no time for re-dissolving since the evaporation process starts immediately.

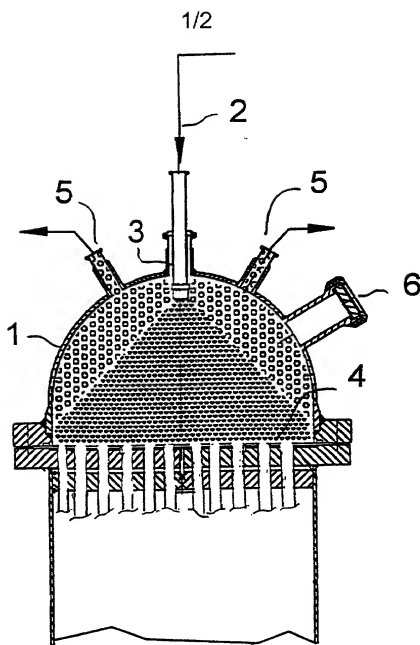


Fig. 1

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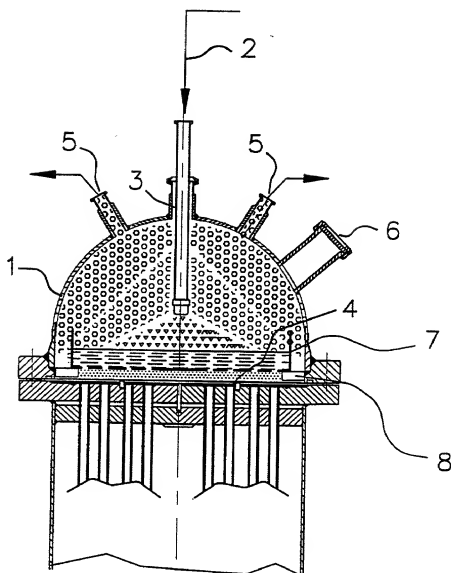


Fig.2

Docket No.: MED 2 1233

DECLARATION FOR PATENT APPLICATION

As the below named inventor, I hereby declare that:

My residence, post office address, and citizenship are as stated below next to my name.

I believe I am the original, sole, and first inventor of the subject matter which is claimed and for which a patent is sought on the invention entitled:

METHOD AND DEVICE FOR TREATING WATER FOR EVAPORATION

the specification of which is attached hereto.

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to the examination of this application in accordance with Title 37, Code of Federal Regulations, § 1.56(a).

I hereby claim foreign priority benefits under Title 35, United States Code § 119(a)-(d) of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed:

Entry of International Application No. PCT/FI99/00928;
Filed November 8, 1999.

Priority Finland Patent Application No. FI 982428,
Filed November 9, 1998 in Finland.

I hereby claim benefit under Title 35, United States Code § 119(e) of any United States provisional applications listed below:

None

I hereby claim the benefit under Title 35, United States Code, § 120 of any United States application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior

United States application in the manner provided by the first paragraph of Title 35, United States Code, § 112.

I acknowledge the duty to disclose material information as defined in Title 37, Code of Federal Regulations, § 1.56(a) which occurred between the filing date of the prior application and the national or PCT international filing date of this application:

None

I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith:

2
Thomas E. Kocovsky, Jr., Reg. No. 28,383
Ann M. Skerry, Reg. No. 45,655

Address all telephone calls to: Thomas E. Kocovsky, Jr.
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FAY, SHARPE, FAGAN,
MINNICH & MCKEE, LLP
1100 Superior Avenue, Seventh Floor
Cleveland, Ohio 44114-2518

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

1-00
Full name of first sole inventor: Mauri (nmi) SALMISUO

Inventor's signature Mauri Salmisuo

Date: 20th April, 2001

Residence: Marsuntie 12-14 C11

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Citizenship: Finland

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FIN-04320 TUUSULA FINLAND